

## **IN THE CLAIMS**

1. (Currently Amended) An apparatus, comprising a multiplexing unit which includes:

an optical input terminal to which can be applied an optical input signal that includes a plurality of optical component signals which are different;

an optical output terminal at which said multiplexing unit produces an optical output signal;

a plurality of protection input terminals;

a plurality of protection output terminals;

~~a further terminal;~~

a demultiplexer having an input coupled to said optical input terminal, and having a plurality of outputs, said demultiplexer being operable to optically isolate the component signals of the input signal, and to optically supply each of the isolated component signals to a respective one of said outputs thereof;

a plurality of switching units each having first and second inputs and first and second outputs, each said switching unit being capable of optically coupling said first output thereof to a selected one of said first and second inputs thereof, and being capable of optically coupling said second output thereof to a selected one of said first and second inputs thereof, wherein said outputs of said demultiplexer are each coupled to said first input of a respective said switching unit, said protection input terminals are each coupled to said second input of a respective said switching unit, and said protection output terminals are each coupled to said second output of a respective said switching unit;

a multiplexer having an output coupled to said optical output terminal, and having a plurality of inputs which are each coupled to said first output of a respective said switching unit, said multiplexer being operable to optically multiplex onto said output respective optical component signals present at each of said inputs thereof;

an optical drop coupler coupled between said optical input terminal and said demultiplexer, said optical drop coupler being operable to forward a first copy of said input signal to said demultiplexer and to drop a second copy of said input signal; and

one or more drop terminals each operable to receive a respective one of said optical component signals included in said second copy of said optical signal dropped by said optical drop coupler.

~~a first portion operable to cause one of the component signals from the optical input terminal to be routed to said further terminal; and~~

~~a second portion operable to cause a component signal present at said further terminal to be included in the optical output terminal.~~

2. (Original) An apparatus according to Claim 1, wherein each said switching unit includes a first optical switch having first and second inputs respectively coupled to said first and second inputs of the switching unit, and having first and second outputs respectively coupled to said first and outputs of the switching unit.

3. (Original) An apparatus according to Claim 1, wherein each said switching unit includes a third output, and is capable of optically coupling said third output to a selected one of said first and second inputs.

4. (Currently Amended) An apparatus according to Claim 3, wherein ~~said multiplexing unit includes a plurality of drop terminals, one of which is said further terminal; and wherein said portion of said multiplexing unit couples each of said one or more drop terminal~~ terminals is coupled to said third output of a respective said switching unit.

5. (Original) An apparatus according to Claim 3, wherein each said switching unit includes:

a first optical switch having first and second inputs respectively coupled to said first and second inputs of the switching unit, having a first output coupled to said first output of the switching unit, and having a second output; and

a second optical switch having an input coupled to said second output of said first optical switch, and having first and second outputs which are respectively coupled to said second and third outputs of the switching unit.

6. (Cancelled)

7. (Cancelled)

8. (Cancelled)

9. (Cancelled)

10. (Cancelled)

11. (Allowed) An apparatus, comprising a multiplexing unit which includes:

- an optical input terminal to which can be applied an optical input signal that includes a plurality of optical component signals which are different;
- an optical output terminal at which said multiplexing unit produces an optical output signal;
- a plurality of protection input terminals;
- a plurality of protection output terminals;
- a further terminal;
- a demultiplexer having an input coupled to said optical input terminal, and having a plurality of outputs, said demultiplexer being operable to optically isolate the component signals of the input signal, and to optically supply each of the isolated component signals to a respective one of said outputs thereof;
- a plurality of switching units each having first and second inputs and first and second outputs, each said switching unit being capable of optically coupling said first output thereof to a selected one of said first and second inputs thereof, and being capable of optically coupling said second output thereof to a selected one of said first and second inputs thereof, wherein said outputs of said demultiplexer are each coupled to said first input of a respective said switching unit, said protection input terminals are each coupled to said second input of a respective said switching unit, and said protection output terminals are each coupled to said second output of a respective said switching unit;
- a multiplexer having an output coupled to said optical output terminal, and having a plurality of inputs which are each coupled to said first output of a respective said switching unit, said multiplexer being operable to optically multiplex onto said output respective optical component signals present at each of said inputs thereof;
- a portion operable to facilitate one of: causing one of the component signals from the input signal to be routed to said further terminal, and causing a component signal present at said further terminal to be included in the optical output signal;

wherein each said switching unit includes a third input and a third output, is capable of optically coupling said first output thereof to a selected one of said first, second and third inputs thereof, is capable of optically coupling said second output thereof to a selected one of said first, second and third inputs thereof, and is capable of optically coupling said third output thereof to a selected one of said first, second and third inputs thereof;

wherein said multiplexing unit includes a plurality of add terminals, one of which is said further terminal;

wherein said portion of said multiplexing unit couples each said add terminal to said third input of a respective said switching unit;

a first optical switch having first and second inputs respectively coupled to said second and third inputs of the switching unit, and having an output;

a second optical switch having first and second inputs respectively coupled to said first input of the switching unit and said output of said first optical switch, having a first output coupled to said first output of the switching unit, and which has a second output; and

a third optical switch having an input coupled to said second output of said second optical switch, and having first and second outputs respectively coupled to said second and third outputs of the switching unit.

12. (Currently Amended) An apparatus according to Claim 1, wherein said multiplexing unit further includes

~~wherein said further terminal functions as a drop terminal;~~

~~wherein said portion of said multiplexing unit includes an optical coupling section which is coupled between said optical input terminal and said input of said demultiplexer, and includes an optical filter which is coupled between said coupling section and said drop terminal;~~

~~wherein said coupling section supplies said optical input signal to each of said demultiplexer and said optical filter; and~~

~~wherein said one or more optical filters each operable to extracts from said second copy of said input signal and supplies supply to said a respective drop terminal a respective one of said component signals of said second copy of said input signal.~~

13. (Cancelled)

14. (Cancelled)

15. (Original) An apparatus according to Claim 1,

wherein said multiplexing unit includes a plurality of regenerators which are each coupled between a respective output of said demultiplexer and said first input of a respective said switching unit; and

wherein said portion of said multiplexer unit includes a transponder which couples said further terminal to said portion of said multiplexing unit.

16. (Currently Amended) An apparatus, comprising first and second multiplexing units which each include:

an optical input terminal to which can be applied a respective optical input signal that includes a plurality of optical component signals which are different;

an optical output terminal at which said multiplexing unit produces an optical output signal;

a plurality of protection input terminals;

a plurality of protection output terminals;

~~a further terminal;~~

a demultiplexer having an input coupled to said optical input terminal, and having a plurality of outputs, said demultiplexer being operable to optically isolate the component signals of the input signal, and to optically supply each of the isolated component signals to a respective one of said outputs thereof;

a plurality of switching units each having first and second inputs and first and second outputs, each said switching unit being capable of optically coupling said first output thereof to a selected one of said first and second inputs thereof, and being capable of optically coupling said second output thereof to a selected one of said first and second inputs thereof, wherein said outputs of said demultiplexer are each coupled to said first input of a respective said switching unit, said protection input terminals are each coupled to said second input of a respective said switching unit, and said protection output terminals are each coupled to said second output of a respective said switching unit;

a multiplexer having an output coupled to said optical output terminal, and having a plurality of inputs which are each coupled to said first output of a respective said switching unit, said multiplexer being operable to optically multiplex onto said output respective optical component signals present at each of said inputs thereof; and

an optical drop coupler coupled between said optical input terminal and said demultiplexer, said optical drop coupler being operable to forward a first copy of said input signal to said demultiplexer and to drop a second copy of said input signal; and

one or more drop terminals each operable to receive a respective one of said optical component signals included in said second copy of said optical signal dropped by said optical drop coupler;

~~a portion operable to facilitate one of: causing one of the component signals from the optical input terminal to be routed to said further terminal, and causing a component signal present at said further terminal to be included in the optical output terminal;~~

~~—— a first portion operable to cause one of the component signals from the optical input terminal to be routed to said further terminal; and~~

~~—— a second portion operable to cause a component signal present at said further terminal to be included in the optical output terminal;~~

wherein said protection output terminals of said first multiplexing unit are each coupled to a respective said protection input terminal of said second multiplexing unit, and said protection output terminals of said second multiplexing unit are each coupled to a respective said protection input terminal of said first multiplexing unit.

17. (Cancelled)

18. (Currently Amended) An apparatus according to Claim 16 ~~17~~, wherein ~~each said multiplexing unit includes a plurality of drop terminals; and wherein said portion of each said multiplexing unit couples each of said one or more drop terminal terminals of that each multiplexing unit is coupled~~ to said third output of a respective said switching unit of that multiplexing unit.

19. (Cancelled)

20. (Cancelled)



21. (Currently Amended) A network element, comprising:  
an optical input terminal operable to receive on a first span of an optical network an optical input signal that includes a plurality of optical component signals which are different;  
an optical output terminal at which the network element produces an optical output signal on the first span;  
a demultiplexer and a multiplexer coupled between the optical input terminal and the optical output terminal operable to be coupled to a span of an optical network;  
a plurality of switches coupled between the demultiplexer and the multiplexer, the switches each operable to switch an optical signal received from the demultiplexer to a second another span of the optical network ~~an optical signal from the demultiplexer and to at least selectively pass the signal to the multiplexer;~~ and  
a drop coupler splitter ~~coupled to~~ between the optical input terminal and the demultiplexer, the drop coupler splitter ~~operable to~~ drop a first copy of the optical input signal including the a plurality of component signals and to forward a second copy of the optical input signal including the plurality of component signals ~~supply the signal to the demultiplexer.~~

22. (Currently Amended) The network element of Claim 21, further comprising an add coupler ~~a second splitter~~ coupled between to the multiplexer and the optical output terminal, the add coupler ~~second splitter~~ operable to add an add signal to a multiplexed signal generated by the multiplexer.

23. (New) An apparatus, comprising a multiplexing unit which includes:

- an optical input terminal to which can be applied an optical input signal that includes a plurality of optical component signals which are different;
- an optical output terminal at which said multiplexing unit produces an optical output signal;
- a plurality of protection input terminals;
- a plurality of protection output terminals;
- a demultiplexer having an input coupled to said optical input terminal, and having a plurality of outputs, said demultiplexer being operable to optically isolate the component signals of the input signal, and to optically supply each of the isolated component signals to a respective one of said outputs thereof;
- a plurality of switching units each having first and second inputs and first and second outputs, each said switching unit being capable of optically coupling said first output thereof to a selected one of said first and second inputs thereof, and being capable of optically coupling said second output thereof to a selected one of said first and second inputs thereof, wherein said outputs of said demultiplexer are each coupled to said first input of a respective said switching unit, said protection input terminals are each coupled to said second input of a respective said switching unit, and said protection output terminals are each coupled to said second output of a respective said switching unit;
- a multiplexer having an output coupled to said optical output terminal, and having a plurality of inputs which are each coupled to said first output of a respective said switching unit, said multiplexer being operable to optically multiplex onto said output respective optical component signals present at each of said inputs thereof;
- an optical add coupler coupled between said multiplexer and said optical output terminal; and
- one or more add terminals each coupled to said optical add coupler;

wherein said optical add coupler is operable to optically combine optical signals from said output of said multiplexer and from said add terminals in order to obtain said optical output signal for said optical output terminal.

24. (New) An apparatus according to Claim 23, wherein each said switching unit includes a first optical switch having first and second inputs respectively coupled to said first and second inputs of the switching unit, and having first and second outputs respectively coupled to said first and outputs of the switching unit.

25. (New) An apparatus according to Claim 23, wherein each said switching unit includes a third output, and is capable of optically coupling said third output to a selected one of said first and second inputs.

26. (New) An apparatus according to Claim 25, wherein each said switching unit includes:

a first optical switch having first and second inputs respectively coupled to said first and second inputs of the switching unit, having a first output coupled to said first output of the switching unit, and having a second output; and

a second optical switch having an input coupled to said second output of said first optical switch, and having first and second outputs which are respectively coupled to said second and third outputs of the switching unit.

27. (New) An apparatus according to Claim 23,  
wherein each said switching unit includes a third input, is capable of optically coupling said first output thereof to a selected one of said first, second and third inputs thereof, and is capable of optically coupling said second output thereof to a selected one of said first, second and third inputs thereof; and

wherein each said add terminal is coupled to said third input of a respective said switching unit.

28. (New) An apparatus according to Claim 27, wherein each said switching unit includes:

a first optical switch having first and second inputs respectively coupled to said second and third inputs of the switching unit, and having an output; and

a second optical switch having first and second inputs respectively coupled to said first input of the switching unit and said output of said first optical switch, and having first and second outputs respectively coupled to said first and second outputs of the switching unit.

29. (New) An apparatus according to Claim 27,

wherein said multiplexing unit includes a plurality of regenerators which are each coupled between a respective output of said demultiplexer and said first input of a respective said switching unit; and

wherein said portion of said multiplexing unit includes a plurality of transponders which are each coupled between a respective said add terminal and said third input of a respective said switching unit.

30. (New) An apparatus according to Claim 23,

wherein each said switching unit includes a third input and a third output, is capable of optically coupling said first output thereof to a selected one of said first, second and third inputs thereof, is capable of optically coupling said second output thereof to a selected one of said first, second and third inputs thereof, and is capable of optically coupling said third output thereof to a selected one of said first, second and third inputs thereof; and

wherein each said add terminal is coupled to said third input of a respective said switching unit.

31. (New) An apparatus according to Claim 30, wherein said multiplexing unit includes one or more drop terminals, each said drop terminal being coupled to said third output of a respective said switching unit.

32. (New) An apparatus according to Claim 23, wherein said multiplexing unit includes:

an optical drop coupler coupled between said optical input terminal and said demultiplexer, said optical drop coupler being operable to forward a first copy of said input signal to said demultiplexer and to drop a second copy of said input signal; and

one or more drop terminals each operable to receive a respective one of said optical component signals included in said second copy of said optical signal dropped by said optical drop coupler.

33. (New) An apparatus according to Claim 23,

wherein said multiplexing unit includes a plurality of regenerators which are each coupled between a respective output of said demultiplexer and said first input of a respective said switching unit; and

wherein said portion of said multiplexer unit includes a transponder which couples said further terminal to said portion of said multiplexing unit.

34. (New) An apparatus, comprising first and second multiplexing units which each include:

- an optical input terminal to which can be applied a respective optical input signal that includes a plurality of optical component signals which are different;

- an optical output terminal at which said multiplexing unit produces an optical output signal;

- a plurality of protection input terminals;

- a plurality of protection output terminals;

- a demultiplexer having an input coupled to said optical input terminal, and having a plurality of outputs, said demultiplexer being operable to optically isolate the component signals of the input signal, and to optically supply each of the isolated component signals to a respective one of said outputs thereof;

- a plurality of switching units each having first and second inputs and first and second outputs, each said switching unit being capable of optically coupling said first output thereof to a selected one of said first and second inputs thereof, and being capable of optically coupling said second output thereof to a selected one of said first and second inputs thereof, wherein said outputs of said demultiplexer are each coupled to said first input of a respective said switching unit, said protection input terminals are each coupled to said second input of a respective said switching unit, and said protection output terminals are each coupled to said second output of a respective said switching unit;

- a multiplexer having an output coupled to said optical output terminal, and having a plurality of inputs which are each coupled to said first output of a respective said switching unit, said multiplexer being operable to optically multiplex onto said output respective optical component signals present at each of said inputs thereof;

- an optical add coupler coupled between said multiplexer and said optical output terminal; and

- one or more add terminals each coupled to said optical add coupler;

- wherein said optical add coupler is operable to optically combine optical signals from said output of said multiplexer and from said add terminals in order to obtain said optical output signal for said optical output terminal;

wherein said protection output terminals of said first multiplexing unit are each coupled to a respective said protection input terminal of said second multiplexing unit, and said protection output terminals of said second multiplexing unit are each coupled to a respective said protection input terminal of said first multiplexing unit.

35. (New) An apparatus according to Claim 34,

wherein each said switching unit in each said multiplexing unit includes a third input and a third output, is capable of optically coupling said first output thereof to a selected one of said first, second and third inputs thereof, is capable of optically coupling said second output thereof to a selected one of said first, second and third inputs thereof, and is capable of optically coupling said third output thereof to a selected one of said first, second and third inputs thereof; and

wherein said each of said one or more add terminals of each multiplexing unit is coupled to said third input of a respective switching unit of that multiplexing unit.